

Human Factors Aspects of Safety Management Systems

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Introduction

Human and organisational factors now dominate the risks to aviation, and have done so for at least two decades. It is clear, therefore, that an effective safety management system (SMS) must be capable of both identifying and controlling these ‘softer’ and subtler issues. However, the vast majority of regulators and aviation managers have technical and operational backgrounds. So, how would they, in the former instance, recognise and evaluate, and, in the latter case, build and operate effective SMSs? The purpose of this paper is to identify some of the main elements of a good SMS—as judged primarily (but not exclusively) from the perspective of human and organisational factors.

For our present purposes, it will be assumed that SMSs will possess the formal characteristics of the kind spelled out in the *SRG Policy and Guidelines* document (1). That is, they will contain a statement of SM policies and principles together with the necessary safety assurance documentation and risk assessment methodology. These are the bare bones of any SMS. Our concern here is with the characteristics necessary to manage the human and organisational aspects of safety in a principled and beneficial manner.

The shift from rule-based to more goal-based regulation—now apparent in most hazardous technologies—has brought a number of advantages, most particularly in the necessity for regulatees to think for themselves (often for the first time) about the dangers that beset their operations. But it has also brought problems—most especially for the regulator. It has, in short, put regulators between a rock and a hard place. The regulator has two tasks: first, to evaluate the SMS documentation and its associated programmes; second, if the SMS is approved, to check that the organisation remains in compliance with its documentation and programmes. The difficulty with this is that almost any subsequent accident affecting that organisation will put the regulator in the frame. There are two possibilities. The accident occurred as the result of activities that were in compliance with the SMS—in which case, the regulator should not have approved it in the first place. Alternatively, the contributing factors revealed a lack of compliance with the SMS—in which case, it was a failure of regulatory oversight (2). One of the purposes of this paper is to help regulators avoid this trap. Human and organisational factors will always lie at the heart of any system, regardless of whether or not a bad outcome occurs.

On the nature of safety

What does it mean to be safe? The dictionary tells us that it means ‘freedom from danger and risks’ (3). But gravity, terrain, weather and the other natural hazards facing aviation will not go away. So, in the strictest sense of this meaning, aviation can never be safe. A more workable definition would be: ‘the ability of organisations and individuals to deal with risks and hazards so as to avoid damage or losses and yet still achieve their goals.’ Such a view invokes two overriding principles for safety management: the ALARP principle (keep your risks as low as reasonably practicable); and the ASSIB principle (and still stay in business).

Safety has two faces. There is the obvious aspect revealed by accidents, incidents, near misses, exceedances and the like. Then there is a more hidden face relating to the organisation’s ability to withstand the hazards associated with its operations. Since chance plays such a large part in bringing about adverse events, the only manageable course is to strive for as great a degree of resilience, or intrinsic resistance, as can reasonably be achieved.

Two things are necessary to move toward this region of maximum resistance and then—a much harder thing—to stay there for as long as possible. One has to do with the navigational aids—a combination of reactive outcome measures and proactive process measures—and the other concerns the driving forces that would propel the system towards this safety goal. These cultural drivers break down into three components—the three Cs (see ref. 2 for a fuller discussion):

- **Commitment:** In the face of ever-increasing commercial pressures, does the organisation have the will to make SMS tools work effectively?
- **Cognizance:** Does the organisation understand the nature of the ‘safety war’—particularly with regard to the involvement of human and organisational factors?
- **Competence:** Neither of the other two C’s is sufficient without the necessary practical skills. Does the organisation’s SMS possess the right tools, and are they properly understood and utilised appropriately?

The anatomy of a safety management system

The three C’s give us some clue as to the dimensions of an SMSs quality. Next, we need to distinguish the basic structural elements of an SMS to which these criteria can be applied. For this purpose, I have borrowed Earl Wiener’s four P’s (4):

- Principles (or philosophy)
- Policies
- Procedures
- Practices

Of these, the principles (or the underlying philosophy) are at least twice as important as the other three P’s. Without an appropriate set of principles to cascade into and shape the policies, procedures and practices, the SMS would be an empty shell.

Combining the three ‘C’s and the four ‘P’s

Table 1 combines the three ‘C’s and the four ‘P’s to produce a matrix of 12 cells. Of these, nine cells yield the primary indicators for judging the human factors worth of an

SMS. These indicators take the form of both attitudinal and behavioural markers (5). The itemised contents of each of the nine cells are listed below.

Table 1. Combining the 3 ‘C’s and 4 ‘P’s to create 9 sets of indicators.

	Commitment	Cognizance	Competence
Principles	1	2	3
Policies	4	5	6
Procedures		7	8
Practices			9

- Principles and commitment

- Safety is a profit centre rather than a cost centre. Safety is good business. Safety management is an integral part of the business process. It is not an add-on. Safety should be well resourced.
- Top management is ever mindful of the possibility of failure. Past events are carefully reviewed; novel scenarios are imagined. The lessons learned turn into global reforms rather than local repairs.
- Top management is actively engaged in safety-related issues. This goes far beyond merely signing off on the SMS policy statements. Safety issues are considered at high-level meetings on a regular basis, not just after a bad event. Top management’s concern with safety is evident throughout the organisation.

- Principles and cognizance

- The organisation, and particularly its upper echelons, regards safety management as something akin to a continuous and long-term fitness programme rather than a negative production process (i.e., it does not strive for ‘target zero’). It recognises that there are no final victories in the safety war. Human fallibility and natural hazards will never be eliminated, only moderated.
- The organisation understands the person, engineering and system models of safety management (see ref. 2), along with their differing views of error and its management. It recognises the weaknesses of the person approach—attempting to change people rather than their situations.
- The organisation accepts occasional setbacks and nasty surprises as inevitable. It expects its workforce to make errors and trains them to detect and recover them. Safety management should be more concerned with the reduction and containment of bad events than with the ultimately fruitless task of trying to eliminate human fallibility.
- The organisation understands that people at the sharp end are rarely the instigators of accidents; they are more often the inheritors of bad events that have been a long time incubating. Unsafe acts are more profitably regarded as consequences rather than causes. The ‘upstream’ systemic factors are easier to manage than fleeting psychological states such as inattention or forgetfulness. Effective safety management is about managing the manageable.

- Principles and competence

- The organisation recognises that the effective management of safety, just like any other management process, depends critically on the collection, analysis and dissemination of relevant information.
- The organisation recognises the necessity of combining reactive outcome data (accidents, incidents, FOQA, etc) with proactive process information. The latter entails far more than occasional audits. It involves the regular sampling of a variety of organisational parameters (scheduling, planning, resource allocation, procedures, defences, training, communication, production-protection conflicts, and the like), identifying which of these 'vital signs' is most in need of attention, and then carrying out remedial actions (see ref. 2 for a description of some of these proactive instruments).
- The competent organisation recognises that the management component of safety management (receiving information, formulating plans of action, monitoring those actions, communicating, etc.) is often the most vulnerable part of any safety system.
- The competent organisation also recognises that, to a large extent, a safe culture can be socially engineered. This involves changing practices rather than trying to change attitudes and beliefs directly. Effective acting and doing leads to the development of congruent beliefs and attitudes (see ref 2.).

- Policies and commitment

- Safety-related information should have direct access to the top levels of the organisation.
- Being assigned to the safety department should be a fast-track appointment, not an oubliette. Such an appointment should also be accorded an appropriate status and salary.
- It should be company policy to remind all levels of the organisation that safety is everyone's responsibility. This should not be just a matter of lip service to a 'fashionable' doctrine.
- It should also be appreciated that production and protection issues can come into conflict in the short-term and that measures should be in place to recognise and resolve such conflicts in a safe manner (see ref. 2).
- Policies should be in place to encourage messengers. One of the characteristics of 'pathological cultures' is that whistle-blowers and other bearers of bad news are ignored, 'shot' or marginalized (6). In high-reliability or 'generative' organisations, on the other hand, such messengers are encouraged, even rewarded, and their information is listened to and acted upon (7).

- Policies and cognizance

- The organisation should publicly recognise the critical dependence of an effective SMS upon the trust of the workforce—particularly with regard to reporting systems. A safe culture (i.e., an informed culture) is the product of a reporting culture that, in turn, can only arise from a just culture (see ref. 2).
- All safety-critical personnel (and that is nearly everyone) should receive some human factors training. This should be extended to all areas of the organisation: to ground-based personnel as well as flight and cabin crew.

Particular attention should be paid to the training of management and first-line supervisors.

- It should be a matter of policy that the management of at least five potential crises are planned and trained for. Crisis recovery planning should also ensure the minimum disruption of the business process.
- Policies and competence
 - Policies relating to near miss and incident reporting systems (and to HF reports) should make clear the company's stance with regard to giving qualified indemnity against sanctions, confidentiality and/or de-identification, and the separation (organisationally) of the data-collecting department from those involved in disciplinary proceedings.
 - Disciplinary policies should be predicated on an agreed (i.e., negotiated) distinction between acceptable and unacceptable behaviour. It should be recognised that a small proportion of unsafe acts are indeed reckless and warrant severe sanctions. That is, a wholly 'blame-free' culture is unworkable and undesirable. However, it is not enough—for example—to punish all violations; some are committed simply in order to get the job done. The key determinant of blameworthiness is not so much the act itself—error or violation—as the nature of the behaviour in which it was embedded. Did this behaviour involve unwarranted risk-taking? If so, then the act would be culpable regardless of whether it was an error or a violation (2, 8).
- Procedures and cognizance
 - Procedures, particularly in maintenance, should not only explain how the job ought to be done, but also identify the likely error-prone steps in the task.
 - Training in the recognition and recovery of errors should support appropriate procedures. This training should be informed by data on recurrent error traps derived from the safety information reporting systems.
 - It should be acknowledged that procedures (being feed-forward control devices) cannot cover all circumstances, and that the person on the spot (if sufficiently trained) should be given some measure of discretion. Human variability is a vital defence as well as a source of error.
 - Procedures should be written in close cooperation with those actually experienced in doing the job.
- Procedures and competence
 - Procedures should be appropriate, accessible, intelligible and workable—this hardly needs saying, but the widespread reality suggests otherwise.
 - Procedures should be written with the understanding that people hardly ever read and do at the same time. This means providing a suitable distribution of the relevant information: in written form, as local reminders or as engineered forcing functions. In other words, the organisation should provide a workable balance between knowledge-in-the-head (with all its attendant problems of memory overload and inert knowledge) and knowledge-in-the-world. Such a balance is especially important in relation to intrinsically error-provoking activities such as aircraft maintenance.
- Practices and competence
 - The 'safety health' of the organisation should be continuously monitored using both reactive outcome data and proactive process measures. The

former help to identify recurrent error traps, while the latter focus attention upon current systemic weaknesses.

- There should be rapid, useful and intelligible feedback channels to communicate the lessons learned and the actions needed. Throughout, the accent should be upon generalising (to the system at large) rather than localising identified failures and weaknesses.
- Finally, and perhaps most importantly, there should be visible top-level involvement in safety practices. Management should not only walk the talk, but also talk the walk.

Concluding comments

The various indicators listed above have tried to capture some of the features of resilient or high-reliability organisations, as they are currently known by social scientists. However, the danger in this is that it could convey the impression that there is one best way of conceiving and implementing a safety management programme. This is certainly not the case. Different programmes suit different purposes and different cultures. Small companies do not necessarily have the same concerns or problems as larger ones. Moreover, it is very unlikely that any real-life organisation—large or small—possesses, or will ever possess, all of these features. Rather, the indicators presented here should be seen for what they are—an attempt to identify some of the major dimensions of excellence as they relate to the all-important area of human and organisational factors.

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Biographical note

James Reason has been Professor of Psychology at the University of Manchester since 1977, from where he graduated in 1962. He obtained his PhD from the University of Leicester in 1967 and has worked at RAF Institute of Aviation Medicine and the US Naval Aerospace Medical Institute. He is the author of a numerous books and papers on human factors and safety. These include: *Human Error* (1990), *Beyond Aviation Human Factors* (with D. Maurino et al., 1994) and *Managing the Risks of Organizational Accidents* (1997). In 1995, he received the Distinguished Foreign Colleague Award of the US Human Factors and Ergonomics Society. He is a Fellow of the British Psychological Society, the Royal Aeronautical Society and the British Academy.